Marine and Coastal Data Products

User Guide

Version 1.5

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Annex 1 Marine Themes Feature Catalogue

Preface

This user guide provides an overview of the family of Marine and Coastal Data Products created and maintained by OceanWise Limited. It provides guidelines on how to derive the maximum benefit from the products and answers many common questions.

If you experience any problems using the data and you have obtained a copy or are accessing the data from an OceanWise distributor, please contact your distributor. If not, or you have any other concerns, please email OceanWise directly at info@oceanwise.eu.

We would like to know what you think of the data and supporting documents including this user guide. Please email your comments to info@oceanwise.eu.

Usage of the data is in accordance with the standard terms and conditions document you received with your order.

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Acknowledgement: This product has been derived in part from material obtained from the UK Hydrographic Office with the permission of the UK Hydrographic Office, Her Majesty's Stationery Office and other relevant authorities.

1 Introduction

This document provides details of the family of Marine and Coastal Data Products available from OceanWise either directly or via a distributor. A list of current distributors is available on the OceanWise website. The User Guide has been prepared to help users understand the contents of the datasets provided, details of the nature and provenance of the data, and how maximum benefit can be gained from its use.

Having read this document carefully, if you have any questions about the products, or have any suggestions about how the data products or accompanying documentation – including this user guide – can be improved, please do not hesitate to contact us.

The Marine and Coastal Data Products currently available comprise:

- Raster Charts
- Marine Themes
- Marine Themes Digital Elevation Model (DEM)

Each of these products is described separately in the following sections.

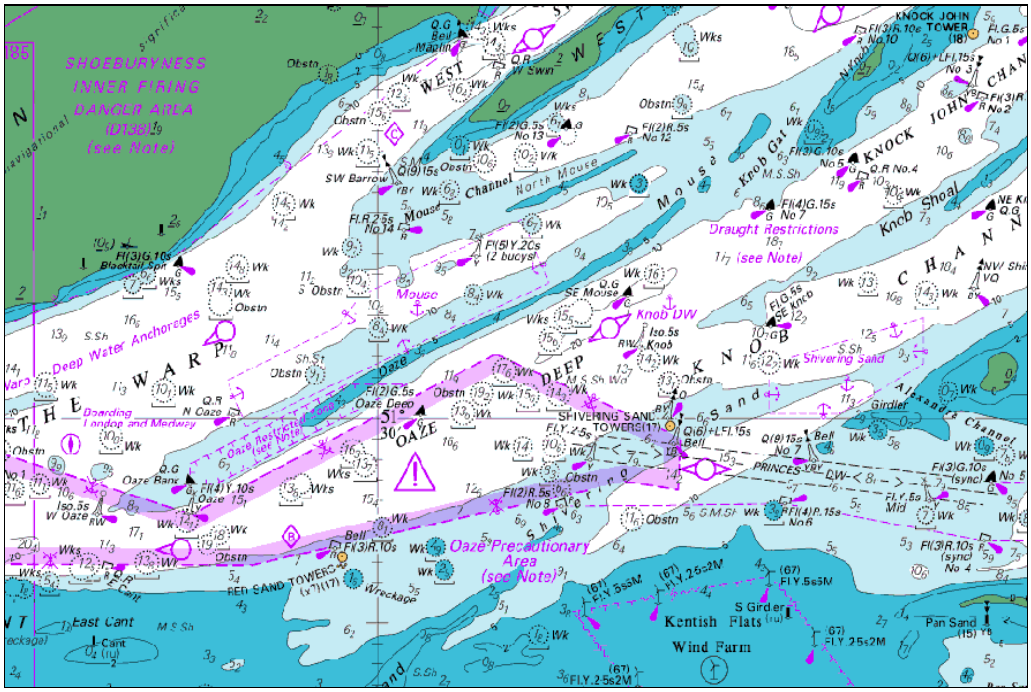


Figure 1 Screenshot of Raster Charts in GIS

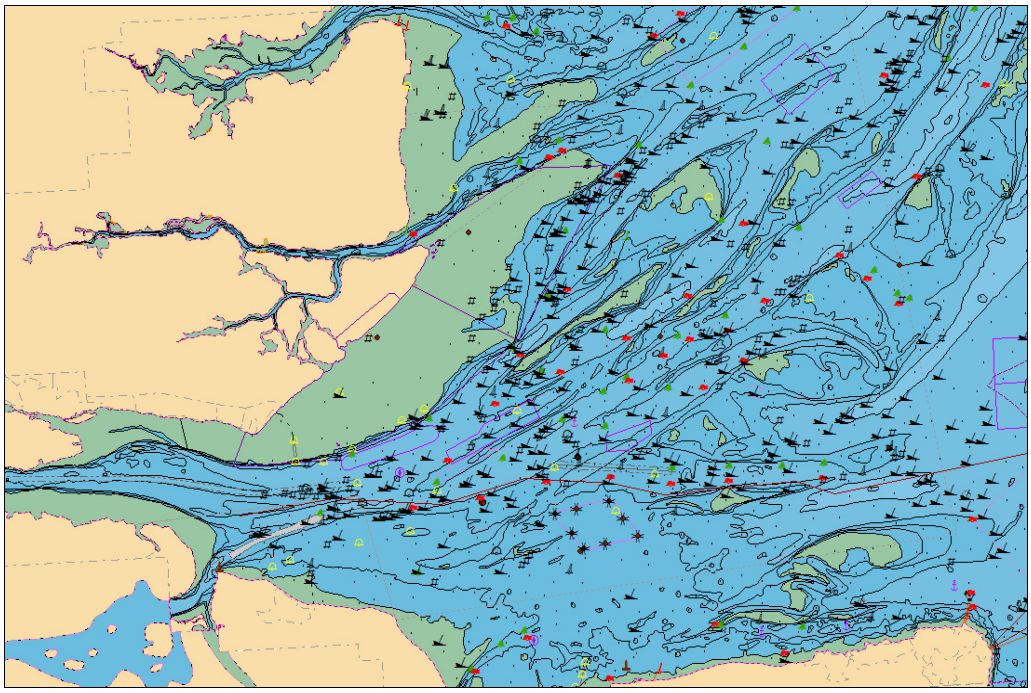
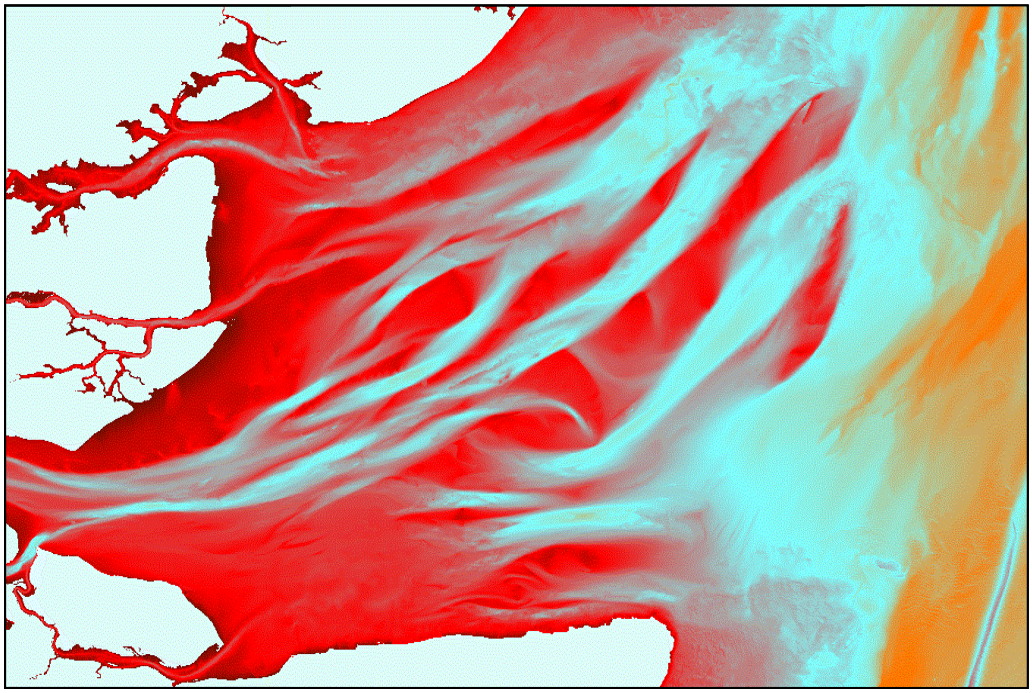


Figure 2 Screenshot of Marine Themes in GIS



2 Raster Charts

2.1 Background

Raster Charts comprises the well-known and popular nautical chart series from the UK Hydrographic Office, supplied as individual image files for easy loading and use in geographical information systems (GIS). It provides a comprehensive marine map base and is ideal for applications where a set of familiar features and related symbology is required for reference or as a backdrop to other data.

The Product is supplied as individual charts at different scales depending on their geographic coverage. Small scale charts cover the whole of British Waters, for example, while large scale charts cover individual estuaries and harbours in greater detail. There are many different scales of chart depending on the geographic area they cover.

Because of the way the original charts are compiled, individual charts may overlap with adjacent charts at the same or different scale levels, and charts at a given scale level may not provide complete coverage, the latter being particularly true for large scale charts that cover, for example, the approaches to a harbour or the harbour itself.

For convenience, we have grouped charts of a similar scale level into bands corresponding to the following levels:

- Small: Chart scales of less than 1: 150,000
- Medium: Chart scales of equal to or greater than 1:150,000, and less than 1: 30,000
- Large: Chart scales equal to or greater than 1: 30,000.

Customers may choose to purchase a single chart or a number of charts covering a similar area by selecting these within the scale bands described above.

Because of the way Hydrographic Offices charge for content, more than one chart may be automatically included in your selection for no additional cost. However, if a single chart is required, without purchasing other charts in the same scale band and selected area, this may be arranged. In a few cases, some very small scale charts (of less than 1: 350,000) may attract a discount. Please contact us with your requirements and we will be pleased to provide advice and, if appropriate, revised pricing for single charts.

The UK Hydrographic Office website contains the details of all original charts and their geographic coverage. Please note though that not all of these charts have been captured digitally and a few that have been captured cannot be supplied for reasons of copyright or national security.

Please contact us if you require a chart that you know exists in its original form but that you cannot find on your chosen distributor's website.

2.2 File Naming

Each chart is provided as a separate file that is named according to the number of the original chart. Where the original chart contained smaller charts, known as panels, on the same sheet, each panel chart is provided as a separate file using the following naming convention:

- For charts comprising a main chart and one or more smaller charts on the same sheet, these are supplied as separate files and are given the name XXXX-0 for the main chart and XXXX-1 for the first panel, XXXX-2 for the second panel etc.
- For charts comprising two or more smaller charts on the same sheet without a main chart, these are also supplied as separate files but the file named XXXX-0 is omitted.

2.3 Coordinate Reference System

Charts are mostly standardised to the WGS84 Datum, especially in UK waters, and are projected either to Mercator or Transverse Mercator. The files containing these charts, and any that are referenced to a different system, include appropriate georeference metadata which is available to the user or system to ensure accurate positioning in Geographic Information Systems (GIS).

All depths and drying heights are referenced to Chart Datum, which approximates to Lowest Astronomical Tide (LAT).

2.4 Symbology

Charts are symbolised to the international standard known as INT1. If you are unfamiliar with this standard or you require further information, details are contained in the publication 'Symbols and Abbreviations Used on Admiralty Charts 5011' available from the UK Hydrographic Office and most retail and online chandlers.

2.5 Metadata

Metadata is presently not supplied with the Raster Charts Product.

2.6 Data Formats

The Raster Charts Product is supplied in the GeoTIFF format, which is read by GIS software. If you are a MapInfo user and require TAB files for the charts you have purchased, please contact your distributor or OceanWise directly.

The Raster Charts Product is available in the following delivery methods:

- FTP Download
- CD-ROM or DVD
- Web Mapping Service.

The available delivery methods may vary according to your chosen distributor. Please select one that suits your requirements or contact OceanWise for further information.

3 Marine Themes

3.1 Background

Marine Themes comprises authoritative data from different public sector data agencies, including the UK and other Hydrographic Offices. The dataset uses different sources of data available for a particular feature and scale range, derived either from the production Electronic Navigational Charts (ENCs) or from original source datasets, where available.

Marine Themes is supplied as individual themed layers corresponding to marine reference data or base mapping required for general situation awareness, planning, site selection and investigation and outline engineering design. As with Ordnance Survey MasterMap™ Topography Layer, Marine Themes contains unique identifiers that can be used for data linking and feature attributes that can be queried for differential display and spatial analysis.

3.2 Data Structure

Marine Themes is provided at four levels of scale or resolution, MTS, MTM, MTL and MTF. The first three levels correspond to the compilation scale of the input data where this is derived directly from ENCs. The latter, MTF, corresponds to data that has been acquired from primary sources to create seamless layers of data for a particular Feature Type. Because of the availability and nature of the source data, features are included at the most appropriate level. The four levels are defined as follows:

Small Scale (MTS):	Derived from ENCs in the scale range 1: 150,000 and smaller. Coverage includes all waters
Medium Scale (MTM):	Derived from ENCs in the scale range 1: 150,000 to 1: 30,000. Coverage includes coastal waters
Large Scale (MTL):	Derived from ENCs in the scale range 1: 30,000 and greater. Coverage includes most harbours
Scale Independent (MTF):	Data based on primary sources and provided as a seamless layer of data for all waters

Marine Themes is structured into eight Themes, with each Theme comprising various Feature Types pertinent to that Theme. Summary details are provided below. A full list of Feature Types is provided in Annex 1.

A separate document, the 'Marine Themes Feature Catalogue', contains a full list of Feature Types and their definition. Photographs of features in the real world, and a screenshot of their presence in GIS, are included where available. The catalogue will be available on-line in the near future.

A unique Feature Code and one or more Descriptive Terms define each Feature Type. Feature Codes contain five characters commencing with the number of the relevant theme. For example the Feature Type 'Bathymetry, Area, Subtidal' has the unique Feature Code of 10011, the first 1 indicating the feature belongs to the Theme 'Elevation' (See Annex 1). A list of the Themes is presented in Table 1 below.

The nature or character of each Feature Type is further defined by up to twenty base Attributes, including the Feature Code and Description outlined above. Where the Theme is sourced entirely from a primary data source additional attributes have been added appropriate to the data. The Attributes provided for each Marine Theme is presented in Table 2 overleaf.

Table 1 List of Marine Themes

CODE	NAME	DESCRIPTION
10000	Elevation	The Earth's surface divided into multiple subtidal, intertidal and land areas, contours and spot soundings. Includes bathymetry and multiple shorelines categorised by tidal level and type.
20000	Shipwrecks & Obstructions	Sunken ships and other disused man-made objects. Includes objects being re-used for another purpose and those of historical interest.
30000	Transport	Transport networks and related infrastructure. Includes aids to navigation.
40000	Industrial Facilities	Production, industrial, aquaculture and research facilities. Includes hydrocarbon and renewable energy infrastructure, submarine cables and equipment for environmental monitoring.
50000	Administrative & Management Units	Areas of administration, governance and management at international, national, regional and local levels. Includes national boundaries, dumping sites, safety and prohibition zones and regulated fairways.
60000	Geographical Regions	Names of subtidal and intertidal areas, and other geographical or topographical features of public or historical interest.
70000	Geology	Geological units including bedrock features and sea bed sediments
80000	Tides & Tidal Currents	Tide related features including stations and streams

Please note the following when considering and using attributes:

- Not all Attributes are relevant to all Feature Types and, where this is the case, have been omitted
- Not all records for all Attributes have been populated by the appropriate Hydrographic Office or source data supplier
- Attribute values may be enumerated or contain descriptive text. Where there is descriptive text, spelling and other errors may be present and terms may not be consistent. Typographical errors in attribute data received from Hydrographic Offices have been corrected wherever possible.

Table 2 List of Attributes associated with Marine Themes

ATTRIBUTE NAME	DESCRIPTION	ELEVATION	OBSTRUCTIONS	TRANSPORT	INDUSTRIAL	ADMINISTRATIVE	REGIONS	GEOLOGY	TIDES	ABBRIEVIATED ATTRIBUTE NAME (see note)
GID	Object Identifier	Y	Y	Y	Y	Y	Y	Y	Y	GID
THEME	Theme Name	Y	Y	Y	Y	Y	Y	Y	Y	THEME
FEATURE_CODE	Feature Code	Y	Y	Y	Y	Y	Y	Y	Y	CODE
NAME	Name	Y	Y	Y	Y	Y	Y	Y	Y	NAME
DESCRIPTION	Description	Y	Y	Y	Y	Y	Y	Y	Y	DESCRIPTN
CATEGORY	Category	Y	Y	Y	Y	Y	Y	Y	Y	CATEGORY
SOURCE_DATE	Source date		Y	Y	Y	Y	Y	Y	Y	SOURCE_DAT
SOURCE_INDICATION	Source indication		Y	Y	Y	Y	Y	Y	Y	SOURCE_IND
INFORMATION	Information	Y	Y	Y	Y	Y	Y	Y	Y	INFORMATN
CONDITION	Condition		Y	Y	Y	Y	Y			CONDITION
STATUS	Status		Y	Y	Y	Y	Y			STATUS
RESTRICTIONS	Restrictions		Y	Y	Y	Y	Y			RESTRICTNS
NATIONALITY	Nationality		Y	Y	Y	Y	Y			NATIONALTY
ACCURACY	Accuracy		Y	Y	Y	Y				ACCURACY
MATERIAL	Material	Y	Y	Y	Y			Y		MATERIAL
WATER_LEVEL	Water level	Y	Y		Y					WATER_LVL
HEIGHT	Height				Y					HEIGHT
DEPTH	Depth	Y	Y		Y					DEPTH
DEPTH_MINIMUM	Depth Minimum	Y								DEPTH_MIN
DEPTH_MAXIMUM	Depth Maximum	Y								DEPTH_MAX
MARKER_LIGHT	Light			Y	Y					LIGHT
MARKER_TOPMARK	TopMark			Y	Y					TOPMARK
MARKER_DAYMARK	DayMark			Y	Y					DAYMARK
UPDATED	Date feature was last updated	Y	Y	Y	Y	Y	Y	Y	Y	UPDATED

LEXICON	Lexicon code giving the name of the unit							Y		LEXICON
RCS	Rock Classification Scheme code							Y		RCS
MAX_INDEX	Number representing the maximum age of the unit							Y		MAX_INDEX
MIN_INDEX	Number representing the minimum age of the unit							Y		MIN_INDEX
MAX_TIME	Maximum age in years of the oldest time division during which the geological unit was formed							Y		MAX_TIME
MIN_TIME	Minimum age in years of the youngest time division during which the geological unit was formed							Y		MIN_TIME
AGE	Name of the max and min ages of geochronological time							Y		AGE
EPOCH	Name of the max and min epochs of geochronological time							Y		EPOCH
SUBPERIOD	Name of the max and min subperiods of geochronological time							Y		SUBPERIOD
PERIOD	Name of the max and min periods of geochronological time							Y		PERIOD
ERA	Name of the max and min eras of geochronological time							Y		ERA
EON	Name of the max and min eons of geochronological time							Y		EON
STANDARD_PORT	Name of major port where tidal constituents have been established and act as a								Y	STD_PORT

	reference for a tidal stream									
HAT	Highest Astronomical Tide								Y	HAT
MSL	Mean Sea Level								Y	MSL
LAT	Lowest Astronomical Tide								Y	LAT
MHHW	Mean Higher High Water or Mean High Water (Springs)								Y	MHHW
MLHW	Mean Lower High Water or Mean High Water (Neaps)								Y	MLHW
MHLW	Mean Higher Low Water or Mean Low Water (Neaps)								Y	MHLW
MLLW	Mean Lower Low Water or Mean Low Water (Springs)								Y	MLLW
TIDE_TYPE	Type of tide e.g. Diurnal or semi-diurnal								Y	TIDE_TYPE
CONSTITUENTS	Tidal curve constituents								Y	CONSTITS
DATA	Tidal stream values made up of Standard Port code, Standard Port Name, 13 sets of (time,direction, Spring speed, Neap speed)								Y	DATA

Notes: The abbreviated attribute name is used where the file format cannot support fieldnames of more than 10 characters (e.g. ESRI shapefile).

3.3 INSPIRE Compliance

Please note that all of the Marine Themes, other than the 'Shipwrecks and Obstructions' and Tides themes, correspond to themes contained within Annexes of the INSPIRE Directive[1]. Shipwrecks and Obstructions are not included in the INSPIRE Annexes at present, although shipwrecks that are protected may be included in the Annex I theme 'Protected Sites'.

Whilst it may be possible for Marine Themes to comply with the INSPIRE specifications for data in the future, this is not the case at present. There are a number of factors that do not allow compliance at this stage, including the lack of

[1] Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE).

a published final specification for all relevant themes, the nature and availability of data from public sector data agencies, including the UK and other Hydrographic Offices, and the ability of some GIS to load the GML data format. It is our intention though to create an INSPIRE compliant version of the Marine Themes in the future.

Table 3 Comparison of Marine Themes Data Product with INSPIRE Themes

CODE	MARINE THEMES	INSPIRE THEMES
10000	Elevation	Elevation (Annex I)
20000	Shipwrecks and Obstructions	Not specified - although shipwrecks designated under the Protection of Wrecks Act, 1973 or the Protection of Military Remains Act, 1986 may be included in Protected Sites (Annex I)
30000	Transport	Transport networks (Annex I)
40000	Industrial Facilities	Production and industrial facilities (Annex III) or Agricultural and aquaculture facilities (Annex III)
50000	Administrative and Management Units	Administrative units (Annex I) or Area management / restriction / regulation zones & reporting units (Annex III)
60000	Geographical Regions	Geographical Names (Annex I) or Sea Regions (Annex II)
70000	Geology	Geology (Annex II)
80000	Tides and Tidal Currents	Time series observations is included in Oceanographic Geographical Features (Annex III)

3.4 Source Data Provenance and Scale

Marine Themes has been created from data from different public sector data agencies, including the UK and other Hydrographic Offices. This includes:

- Chart derived data originally captured for the production of Electronic Navigational Charts (ENCs)
- Data collated from various sources and managed by the Hydrographic Office as a primary dataset to support the creation of ENCs and other navigational and defence products.
- Data collated from various sources determined to be the most appropriate data holder.

These sources contain numerous features held to different standards e.g. IHO S-57. Their characteristics and how these are managed in the design and creation of the Marine Themes are explained below.

3.5 Data sourced from ENCs

Many of the features held digitally within Hydrographic Offices only exist in the form they were captured to support the creation of ENCs. In other words, they are only in their product form, rather than as source datasets that can then be used to support product development. As with paper and raster charts (see Section 2), ENCs are compiled at different scale levels, overlap with adjacent ENCs and do not necessarily provide complete coverage of the Earth's surface (sea surface and seabed).

A real world feature may exist in several ENCs at different scales and may be represented differently in each case. For example, at ENC boundaries, a single feature in the real world will be represented as separate records (one for each ENC) with split geometries. Features present on one chart may be missing from an adjacent chart, their geometries discontinuous and their attributes captured differently.

There are many reasons why a feature contained in the data may not be wholly representative of the feature in the real world. This includes how the feature was portrayed by the Hydrographic Office on the original paper chart, the scale of that chart and the precision of capture, digitising errors, deliberate bias towards safety in compilation, and where its purpose is purely cartographic. Examples include the processing and selection of water depth to introduce a shoal bias, the coordinates of administrative areas being offset from any legal definition and geographical regions used for labelling. As a consequence, users should contact OceanWise, the Hydrographic Office or other relevant authority with regard to the accuracy and provenance of a given feature prior to its use for legal, contractual or regulatory purposes.

3.6 Creation of Marine Themes

Marine Themes uses the most complete and comprehensive geometric representation of a real world feature derived from one or more ENC or primary source dataset. This does not mean automatically using the representation of a feature derived from the largest scale ENC, as the feature may not be present at all scale levels, or may not be appropriate to the resolution of the final data product. Where possible, features are joined at chart boundaries to create as near a seamless layer as possible. The most up to date attribute data is used to populate the attributes for each conjoined feature. Errors in spelling or terminology are corrected where these are present and obvious. Where there is any doubt, features are left as separate records. The seeming discrepancy is reported to the relevant Hydrographic Office for consideration and any corrections included in future updates.

Where features exist in primary source datasets, these are used to complement or replace those features derived from ENCs, as they are more comprehensive and accurate. Examples where this is the case include the 'Wrecks and Obstructions Theme' and 'Military Practice Areas' Feature Type. As Hydrographic Offices streamline their production lines and aim to make their data fit for uses other than navigation, it is expected that more data will be managed at source and hence used to replace ENC derived data in Marine Themes. We continue to work closely with Hydrographic Offices to encourage and help with this process.

3.7 Coordinate Reference System

The Marine Themes Data Product is standardised to the WGS84 Datum (EPSG:4326) and geometries are presented in geographic coordinates (i.e.

latitude and longitude). Please note that some sources of data are either referenced to the ETRS89 Datum (EPSG:4258) or would be better referenced to this datum as it is the local realisation of WGS84 in Europe to allow for plate tectonics. Presently, the difference between WGS84 and ETRS89 is around 0.5 m and for the different datums can be used synonymously for most purposes other than for tasks where highly accurate positioning is required.

In Great Britain, datum transformation available in GIS can be used to combine marine themes with land data products, although these transformations should be used with caution. Please note that due to the nature and provenance of different source data, land and marine features are unlikely to align exactly along a common coastline.

All depths and drying heights are referenced to Chart Datum, which approximates to Lowest Astronomical Tide (LAT). For some purposes, depths may need to be referenced to a different datum. This includes environmental modelling where Mean Sea Level is required, and integration with land height data where a land datum such as Ordnance Survey (Newlyn) is required.

Please contact us for further details and if you would like transformations or harmonisation work to be undertaken on your behalf.

3.8 Metadata

Discovery metadata is supplied with Marine Themes created to the ISO 19115/19139 standard using the current MEDIN profile (see www.oceannet.org for details). The MEDIN profile is a superset of the Gemini 2.1 profile, which is used widely in the UK.

In addition to dataset level i.e. discovery metadata, record level i.e. use metadata is supplied with Marine Themes as an attribute of all features types, providing the user with essential information on the source of each feature and, where known, the accuracy and method of capture.

3.9 Data Formats

The Marine Themes Product is supplied in a number of data formats which are listed below:

- GML
- ESRI Shapefile
- MapInfo TAB
- MapInfo MID/MIF

The Marine Themes Product is available in the following delivery methods:

- FTP Download
- CD-ROM or DVD

- Web Mapping Service
- Web Feature Service.

The available formats and delivery methods may vary according to your chosen distributor. Please select one that suits your requirements or contact OceanWise for further information.

3.10 Symbology

Symbology may be applied to Marine Themes to determine how the data is portrayed in GIS. How this is achieved depends on the format in which the data is supplied and the target application. Descriptions of the methods used for commonly used systems are provided below.

ESRI Layer Files are supplied with the data, which applies standard ESRI symbology. There is a Layer File (*.lyr – ArcGIS 9.x+) for each theme and scale level, which contains links to the source data. The Layer Files must reside in the same folder as the data.

The following reference scales for each Marine Theme scale level are recommended for users of ESRI ArcGIS:

- Small scale (MTS) 1: 500,000
- Medium scale (MTM) 1: 250,000
- Large scale (MTL) 1: 100,000
- Scale Independent (MTF) 1: 100,000

Due to the way the data is stored and extracted, symbology is not included in MapInfo TAB format automatically. Instead, symbology can be applied to TAB files post supply using a utility tool. Please contact us for details.

Due to the nature of the features within each Theme, the Theme order suggested below will give the best display within a GIS system, where 1 is the top-most Theme on display.

1. Obstructions
2. Tides
3. Industrial
4. Transport
5. Administrative
6. Geology
7. Regions
8. Elevation

Within each Theme, files are provided for Point, Line and Area features. Points should be displayed on top of Lines, which in turn should be displayed on top of Areas.

NOTE: Although all files are supplied for each order, some files may not contain data due to the spatial variation in some features.

4 Marine Themes Digital Elevation Model

4.1 Background

Marine Themes Digital Elevation Model (DEM) comprises a gridded (raster) dataset of seabed elevation relative to a specified datum. The surface has been created from hydrographic survey and chart derived data depending on the data available for a particular area and has a resolution of 1 and 6 arc seconds, which is approximately 30 and 180 m, respectively. The 1 arc second DEM is provided as individually named half degree tiles and the 6 arc second as individually named two degree tiles. Depending on the resolution of input data the 1 arc second DEM is not available for all areas.

The DEM has been created by utilising these different sources of data in order of resolution, survey method and age in a process known as 'de-confliction'. A meta-layer that accompanies the DEM describes the source data used in any given area. The DEM coastline is the High Water Line on the largest scale of ENC available for any given area. This coastline corresponds to the coastline feature contained within Marine Themes (MTL Elevation), conjoined and height attributed to create a contiguous three dimensional line which was used as a break line.

4.2 DEM Creation

4.2.1 Data Sources

Typical sources of data used in the creation of the DEM include:

- Civil and Military Survey Programmes
- Port and Harbour Authorities
- Pipeline, cable and other site surveys from industry
- Output from scientific and environmental studies and surveys
- Compilations of the above used in the creation of ENCs

All of the above sources have been quality controlled, so only those verified as fit for use in charting were used in the creation of the DEM.

Whilst Hydrographic Offices are permitted to use all of the data it holds for charting, some data sources may be restricted for commercial or security reasons. Wherever permitted the most up to date, highest resolution data has been used in DEM creation.

New sources of data either acquired from surveys or released from archive by Hydrographic Offices and other data holders will be incorporated into the DEM during the revision cycle in the future. The meta-layer (also known as a coverage layer) will be updated to reflect these changes.

4.2.2 Data Processing

Individual surveys are reduced to Chart Datum by removing the height of tide (and other effects) at the time and location of measurement. This process is known as tidal correction. Various techniques have been used to do this, depending on the age and extent of the survey. Errors, inaccuracy or imprecision in the way surveys are reduced can lead to artefacts in the data. These include height differences between adjacent surveys (Figure 4), and the appearance of cross and tramlines (Figure 5). As the input data and details of how the tidal correction was undertaken are generally unavailable, it is impossible to correct or otherwise remove these artefacts and their presence should be noted in the DEM.

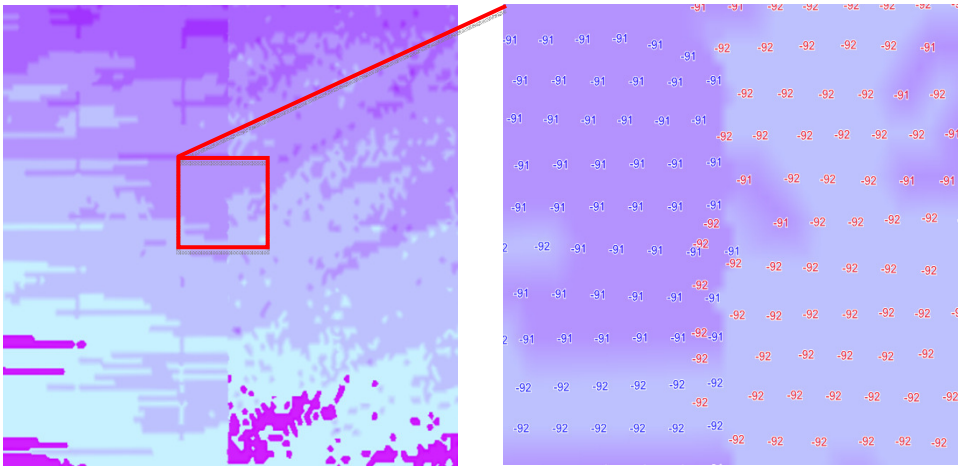


Figure 4 Steps in the DEM as a result of Height Differences in Source Data

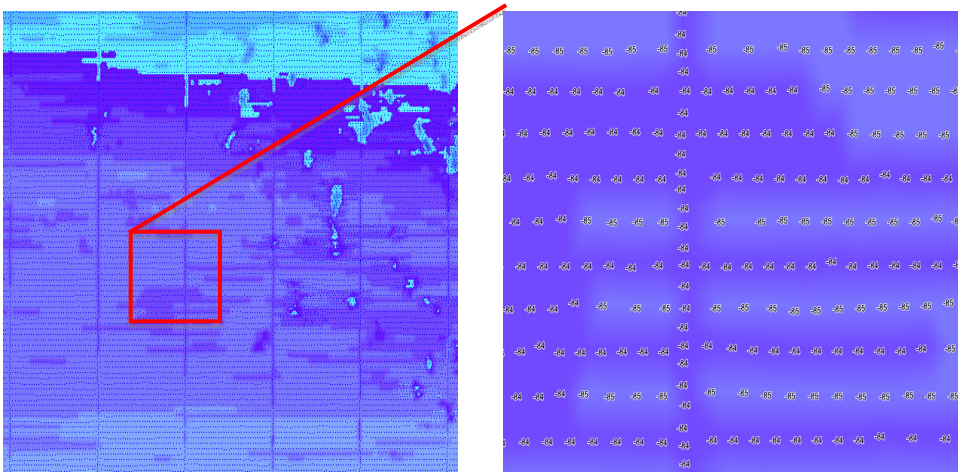


Figure 5 Cross (vertical) and Tram (horizontal) Lines inherent in some Source Data and hence in DEM

Soundings on shipwrecks and other manmade objects have not been removed from data received digitally from Hydrographic Offices and hence appear in the

DEM as anomalies or 'spikes' (Figure 6). General policy is not to remove any soundings in the vicinity of a wreck, so as not to leave a hole in the data. Any information about a wreck gathered by a systematic investigation (e.g. the least depth - perhaps gathered by a wire sweep) is rendered by the survey vessel and is recorded separately. This information was not used in creation of the DEM.

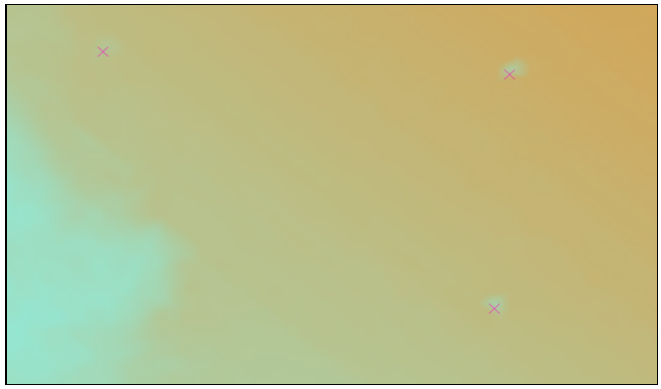


Figure 6 Section of DEM indicating the impact of Shipwrecks in the Source Data (a cross indicates a shipwreck)

4.3 Coordinate Reference System

The horizontal datum of the DEM is the WGS84 Datum (EPSG: 4326). Where the source data was determined to be on the WGS84 or the ETRS89 Datum (EPSG: 4258), the local equivalent to WGS84 for Europe, the data was used as read. Where the source data was determined to be in a datum other than WGS84, a datum transformation was undertaken to as high degree of accuracy as possible.

The vertical datum of the source data, and hence the resulting DEM, was standardised on Chart Datum. Chart Datum is commonly used by Hydrographic Offices and other organisations as the reference datum for marine depths (and drying heights), as it approximates to Lowest Astronomical Tide (LAT). As such it is not a geodetic datum but varies from place to place according to tidal range.

In order to use the DEM in a different horizontal Coordinate Reference System (CRS) (e.g. British National Grid) or reference it to a different vertical datum (e.g. Mean Sea Level), for example as input to hydrodynamic modelling, then a transformation needs to be applied.

While it is possible to transform the DEM to another CRS horizontally, the DEM will become distorted. It is more accurate to transform the source data and recreate the DEM in the new CRS. Vertical datum transformation can be applied using a constant shift (for small areas with a similar tidal range) or by applying a separation model, such as that available as the UK Hydrographic Office's Vertical Offshore Reference Frame (VORF). Transformations are available from OceanWise as an additional service.

Please contact your chosen distributor or OceanWise directly for details.

4.4 File Naming

Each half degree (1 arc second DEM) or two degree (6 arc second DEM) tile is provided as an individual file named according to the following convention. Each file is prefixed with "MTF", which means Marine Themes Feature:

TGYYYHXXXX.asc e.g. MTF5051010050.asc

Where T is the tile size (5 for 0.5 degrees, 2 for 2 degrees)
G denotes the northern or southern hemisphere, 0 for north and 1 for south
YYY is the latitude of the most southern and most western corner of the tile e.g. 505 is 50.5 degrees or 50 degrees 30 minutes
H denotes the eastern or western hemisphere, 0 for east and 1 for west
XXXX is the longitude of the most southern and western corner of the tile e.g. 0050 is 005.0 degrees or 005 degrees 0 minutes
.asc is the extension of the file indicating its format e.g. ASCII grid.

4.5 Symbology

OceanWise provides a recommended colour ramp for its DEM. The colour ramp is contained within a Layer file (for ESRI ArcGIS users) which is available from your chosen distributor. Shading and other relief effects can be added as required. Please consult you GIS manual for details.

4.6 Metadata

Discovery metadata is supplied with Marine DEM created to the ISO 19115/19139 standard using the current MEDIN profile (see www.oceannet.org for details). The MEDIN profile is a superset of the Gemini 2.1 profile, which is used widely in the UK.

In addition to dataset level i.e. discovery metadata, evaluation level metadata is supplied in the form of a meta-layer or coverage layer describing the input data used in DEM creation for any given area. This meta-layer is supplied as a separate file in GIS format e.g. GML.

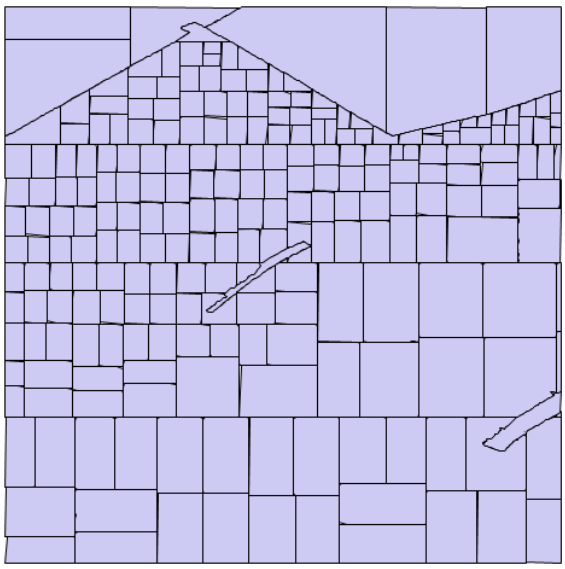


Figure 7 Example of the Meta-Layer or (Coverage Layer)

Figure 7 is a screenshot in GIS showing the extents of each survey block used in DEM creation for the area shown. The meta-layer has the attributes described below.

	Source Data Type	
Attribute	**Survey**	**ENC**
IDTILE	Unique Identifier of the tile - used in the File Naming.	
IDMETADATA	Unique identifier of the Survey	Identifier of the ENC Intended Usage Band used: 1=Overview, 2=General, 3=Coastal, 4=Approach, 5=Harbour, 6=Berthing
NAME	UKHO Identifier of the Survey - either Bathy ID, SDRA Number	S57 Cell name
DESCRIPTN	Descriptive title of the survey - where this is available	Description of the feature used to describe the coverage Either general "Coverage" or "Survey Reliability" where that information is available in ENCs
INFORMATN	General Information about the Survey, as exists in the XYZ or ENC Metadata. Or 'Interpolated' where holes were filled	
NATIONALTY	Source nation of the data	
SCALE	Compilation Scale of the data – if applicable and where known	
SOURCE_DAT	Survey Start and End dates - as encoded in ENC SURSTA, SUREND and SORDAT - where available	

SOURCE_IND	Concatenation of source identifiers, where known e.g. for GB data: HOID Hydrographic Identifier ORID Originators Identifier HOIN Hydrographic Instruction	ENC Source Indication - encoded as SORIND (S-57 Attribute)
UPDATED	Date the data was incorporated into the output Grid	

4.7 Data Formats

The Marine DEM is supplied in a number of data formats which are listed below:

- ESRI ASCII Grid
- Surfer 7 Grid
- GeoTIFF

It is available in the following delivery methods:

- FTP Download
- CD-ROM or DVD
- Web Mapping Service.

The available formats and delivery methods may vary according to your chosen distributor. Please select one that suits your requirements or contact OceanWise for further information.

Annex 1 – Marine Themes List of Feature Types

FEATURE CODE	THEME	DESCRIPTION
10010	Elevation	Bathymetry, Area, Undefined
10011	Elevation	Bathymetry, Area, Subtidal
10013	Elevation	Bathymetry, Area, Intertidal
10014	Elevation	Bathymetry, Area, Dredged
10015	Elevation	Bathymetry, Area, Land
10021	Elevation	Bathymetry, Contour
10022	Elevation	Bathymetry, Sounding
10031	Elevation	Coastline, Natural
10032	Elevation	Coastline, Man made
20010	Wrecks and Obstructions	Obstruction, Undefined
20011	Wrecks and Obstructions	Obstruction, Snag or stump
20015	Wrecks and Obstructions	Obstruction, Fish haven
20016	Wrecks and Obstructions	Obstruction, Foul area
20017	Wrecks and Obstructions	Obstruction, Foul ground
20019	Wrecks and Obstructions	Obstruction, Ground tackle
20020	Wrecks and Obstructions	Wreck, Undefined
20021	Wrecks and Obstructions	Wreck, Non-dangerous wreck
20022	Wrecks and Obstructions	Wreck, Dangerous wreck
20023	Wrecks and Obstructions	Wreck, Distributed remains of wreck
20024	Wrecks and Obstructions	Wreck, Wreck showing mast/masts
20025	Wrecks and Obstructions	Wreck, Wreck showing any portion of hull or superstructure
20030	Wrecks and Obstructions	Hulk
20040	Wrecks and Obstructions	Obstruction, Underwater rock
31010	Transport	Beacon, Cardinal, Undefined
31011	Transport	Beacon, Cardinal, North
31012	Transport	Beacon, Cardinal, East
31013	Transport	Beacon, Cardinal, South
31014	Transport	Beacon, Cardinal, West
31030	Transport	Beacon, Isolated danger
31040	Transport	Beacon, Lateral, Undefined
31041	Transport	Beacon, Lateral, Port
31042	Transport	Beacon, Lateral, Starboard
31043	Transport	Beacon, Lateral, Preferred channel, Starboard
31044	Transport	Beacon, Lateral, Preferred channel, Port
31050	Transport	Beacon, Safe water
31060	Transport	Beacon, Special purpose/general
32010	Transport	Buoy, Cardinal, Undefined
32011	Transport	Buoy, Cardinal, North
32012	Transport	Buoy, Cardinal, East
32013	Transport	Buoy, Cardinal, South

FEATURE CODE	THEME	DESCRIPTION
32014	Transport	Buoy, Cardinal, West
32020	Transport	Buoy, Installation
32030	Transport	Buoy, Isolated danger
32040	Transport	Buoy, Lateral, Undefined
32041	Transport	Buoy, Lateral, Port
32042	Transport	Buoy, Lateral, Starboard
32043	Transport	Buoy, Lateral, Preferred channel, Starboard
32044	Transport	Buoy, Lateral, Preferred channel, Port
32050	Transport	Buoy, Safe water
32060	Transport	Buoy, Special purpose/general
33010	Transport	Light float
33020	Transport	Light vessel
34020	Transport	Route, Undefined
34021	Transport	Route, Deep water, Centreline
34022	Transport	Route, Deep water, Part
34023	Transport	Route, Fairway
34024	Transport	Route, Recommended, Centreline
34025	Transport	Route, Recommended, Part
34026	Transport	Route, Recommended, Track
34027	Transport	Route, Recommended, Two-way
34030	Transport	Route, Ferry, Undefined
34031	Transport	Route, Ferry, Free-moving
34032	Transport	Route, Ferry, Cable
34033	Transport	Route, Ferry, Ice
35010	Transport	Navigation line, Undefined
35011	Transport	Navigation line, Clearing line
35012	Transport	Navigation line, Transit line
35013	Transport	Navigation line, Leading line
40010	Industrial Facilities	Pile, Undefined
40011	Industrial Facilities	Pile, Stake
40012	Industrial Facilities	Pile, Snag
40013	Industrial Facilities	Pile, Post
40014	Industrial Facilities	Pile, Tripodal
41000	Industrial Facilities	Harbour facility, Undefined
41010	Industrial Facilities	Harbour facility, Dry dock
41020	Industrial Facilities	Harbour facility, Pontoon
41030	Industrial Facilities	Harbour facility, Mooring/Warping facility, Undefined
41031	Industrial Facilities	Harbour facility, Mooring/Warping facility, Dolphin
41032	Industrial Facilities	Harbour facility, Mooring/Warping facility, Deviation dolphin
41033	Industrial Facilities	Harbour facility, Mooring/Warping facility, Bollard
41034	Industrial Facilities	Harbour facility, Mooring/Warping facility, Tie-up wall

FEATURE CODE	THEME	DESCRIPTION
41035	Industrial Facilities	Harbour facility, Mooring/Warping facility, Post or pile
41036	Industrial Facilities	Harbour facility, Mooring/Warping facility, Chain/wire/cable
41037	Industrial Facilities	Harbour facility, Mooring/Warping facility, Mooring buoy
41040	Industrial Facilities	Harbour facility, Boom
42010	Industrial Facilities	Marine farm/culture, Undefined
42011	Industrial Facilities	Marine farm/culture, Crustaceans
42012	Industrial Facilities	Marine farm/culture, Oysters/mussels
42013	Industrial Facilities	Marine farm/culture, Fish
42014	Industrial Facilities	Marine farm/culture, Seaweed
42015	Industrial Facilities	Marine farm/culture, Pearl culture farm
42020	Industrial Facilities	Fishing facility, Undefined
42021	Industrial Facilities	Fishing facility, Fishing stake
42022	Industrial Facilities	Fishing facility, Fish trap
42023	Industrial Facilities	Fishing facility, Fish weir
42024	Industrial Facilities	Fishing facility, Tunny net
43001	Industrial Facilities	Offshore platform
43010	Industrial Facilities	Oil barrier, Undefined
43011	Industrial Facilities	Oil barrier, Oil retention (high pressure pipe)
43012	Industrial Facilities	Oil barrier, Floating oil barrier
43024	Industrial Facilities	Log pond
43025	Industrial Facilities	Ice boom
43040	Industrial Facilities	Turbine, Undefined
43041	Industrial Facilities	Turbine, Wind
43042	Industrial Facilities	Turbine, Tidal
44010	Industrial Facilities	Cable, Submarine, Undefined
44011	Industrial Facilities	Cable, Submarine, Power line
44013	Industrial Facilities	Cable, Submarine, Transmission line
44014	Industrial Facilities	Cable, Submarine, Telephone
44015	Industrial Facilities	Cable, Submarine, Telegraph
44016	Industrial Facilities	Cable, Submarine, Mooring cable/chain
44020	Industrial Facilities	Pipeline, Undefined
44021	Industrial Facilities	Pipeline, Joint
44022	Industrial Facilities	Pipeline, Manifold
44030	Industrial Facilities	Wellhead
44040	Industrial Facilities	Diffuser
44050	Industrial Facilities	Crib
44060	Industrial Facilities	Storage tank
44080	Industrial Facilities	Installation, Undefined
44081	Industrial Facilities	Installation, Template
48010	Industrial Facilities	Mast
51000	Administrative Units	Administration Area, Undefined
51001	Administrative Units	Administration Area, International

FEATURE CODE	THEME	DESCRIPTION
51002	Administrative Units	Administration Area, National
51003	Administrative Units	Administration Area, National sub-division
51010	Administrative Units	Contiguous zone
51020	Administrative Units	Continental shelf area
51030	Administrative Units	Exclusive Economic Zone (EEZ)
51040	Administrative Units	Territorial sea area
51050	Administrative Units	Fishery zone
52010	Administrative Units	Harbour area (administrative)
52020	Administrative Units	Dock area, Undefined
52021	Administrative Units	Dock area, Tidal
52022	Administrative Units	Dock area, Non-tidal (wet dock)
52023	Administrative Units	Lock basin
52024	Administrative Units	Anchor berth
52030	Administrative Units	Anchorage area
52040	Administrative Units	Cargo transhipment area
52050	Administrative Units	Pilot boarding place, Undefined
52051	Administrative Units	Pilot boarding place, Boarding by pilot-cruising vessel
52052	Administrative Units	Pilot boarding place, Boarding by helicopter
52053	Administrative Units	Pilot boarding place, Pilot comes out from shore
52071	Administrative Units	Custom zone
52072	Administrative Units	Free port area
52080	Administrative Units	Sea-plane landing area
53010	Administrative Units	Traffic zone, Undefined
53011	Administrative Units	Traffic zone, Inshore
53012	Administrative Units	Traffic separation, Boundary
53013	Administrative Units	Traffic separation, Crossing
53014	Administrative Units	Traffic separation, Lane part
53015	Administrative Units	Traffic separation, Line
53016	Administrative Units	Traffic separation, Roundabout
53017	Administrative Units	Traffic separation, Zone
53020	Administrative Units	Submarine transit lane
54010	Administrative Units	Dumping ground
54020	Administrative Units	Incineration area
54030	Administrative Units	Military practice area
54040	Administrative Units	Offshore production area
54050	Administrative Units	Restricted area
54060	Administrative Units	Fishing ground
60000	Geographical Regions	Sea area/named water area, Undefined
60001	Geographical Regions	Sea area/named water area, Sea area in general
60002	Geographical Regions	Sea area/named water area, Gat
60003	Geographical Regions	Sea area/named water area, Bank
60004	Geographical Regions	Sea area/named water area, Deep
60005	Geographical Regions	Sea area/named water area, Bay

FEATURE CODE	THEME	DESCRIPTION
60006	Geographical Regions	Sea area/named water area, Trench
60007	Geographical Regions	Sea area/named water area, Basin
60008	Geographical Regions	Sea area/named water area, Mud flats
60009	Geographical Regions	Sea area/named water area, Reef
60010	Geographical Regions	Sea area/named water area, Ledge
60011	Geographical Regions	Sea area/named water area, Canyon
60012	Geographical Regions	Sea area/named water area, Narrows
60013	Geographical Regions	Sea area/named water area, Shoal
60014	Geographical Regions	Sea area/named water area, Knoll
60015	Geographical Regions	Sea area/named water area, Ridge
60016	Geographical Regions	Sea area/named water area, Seamount
60017	Geographical Regions	Sea area/named water area, Pinnacle
60018	Geographical Regions	Sea area/named water area, Abyssal plain
60019	Geographical Regions	Sea area/named water area, Plateau
60020	Geographical Regions	Sea area/named water area, Spur
60021	Geographical Regions	Sea area/named water area, Shelf
60022	Geographical Regions	Sea area/named water area, Trough
60023	Geographical Regions	Sea area/named water area, Saddle
60024	Geographical Regions	Sea area/named water area, Abyssal hills
60025	Geographical Regions	Sea area/named water area, Apron
60026	Geographical Regions	Sea area/named water area, Archipelagic apron
60027	Geographical Regions	Sea area/named water area, Borderland
60028	Geographical Regions	Sea area/named water area, Continental margin
60029	Geographical Regions	Sea area/named water area, Continental rise
60030	Geographical Regions	Sea area/named water area, Escarpment
60031	Geographical Regions	Sea area/named water area, Fan
60032	Geographical Regions	Sea area/named water area, Fracture zone
60033	Geographical Regions	Sea area/named water area, Gap
60034	Geographical Regions	Sea area/named water area, Guyot
60035	Geographical Regions	Sea area/named water area, Hill
60036	Geographical Regions	Sea area/named water area, Hole
60037	Geographical Regions	Sea area/named water area, Levee
60038	Geographical Regions	Sea area/named water area, Median valley
60039	Geographical Regions	Sea area/named water area, Moat
60040	Geographical Regions	Sea area/named water area, Mountains
60041	Geographical Regions	Sea area/named water area, Peak
60042	Geographical Regions	Sea area/named water area, Province
60043	Geographical Regions	Sea area/named water area, Rise
60044	Geographical Regions	Sea area/named water area, Sea channel
60045	Geographical Regions	Sea area/named water area, Seamount chain
60046	Geographical Regions	Sea area/named water area, Shelf-edge
60047	Geographical Regions	Sea area/named water area, Sill
60048	Geographical Regions	Sea area/named water area, Slope
60049	Geographical Regions	Sea area/named water area, Terrace

FEATURE CODE	THEME	DESCRIPTION
60050	Geographical Regions	Sea area/named water area, Valley
60051	Geographical Regions	Sea area/named water area, Canal
60052	Geographical Regions	Sea area/named water area, Lake
60053	Geographical Regions	Sea area/named water area, River
60054	Geographical Regions	Sea area/named water area, Reach
70010	Geology	Geology, Undefined
70020	Geology	Bedrock
70030	Geology	Sediment
70040	Geology	Fault
70050	Geology	Anticline
70060	Geology	Syncline
70070	Geology	Monocline
70080	Geology	Limit of Subcrop
80010	Tides and Tidal Currents	Tides, Undefined
80020	Tides and Tidal Currents	Tides, Tidal Stream
80030	Tides and Tidal Currents	Tides, Tidal Station